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Let velocity at D for particle from $A=u$, for particle from $B=u_1$; then $u^2=v^2-2gh$, $u_1^2=v_1^2-2gh$. Now $CE=hcotA$, $CF=hcotB$.

$$\therefore EF=h\sqrt{[\cot^2 A + \cot^2 B + 2\cot A \cot B \cos(\theta + \varphi)]} = d.$$

$$CG=\frac{1}{2}\sqrt{[2CE^2 + 2CF^2 - EF^2]} = \frac{1}{2}h\sqrt{[\cot^2 A + \cot^2 B - 2\cot A \cot B \cos(\theta + \varphi)]} = l.$$

$\therefore \tan DGC = h/l = \tan C$, where C =angle of projection of coalesced particles at D . Also $DE=hcosec A$, $DF=hcosec B$.

$$\therefore \cos EDF = \frac{h^2 \operatorname{cosec}^2 A + h^2 \operatorname{cosec}^2 B - d^2}{2h^2 \operatorname{cosec} A \operatorname{cosec} B} = \cos D.$$

$$\therefore \cos D = \sin A \sin B - \cos A \cos B \cos(\theta + \varphi).$$

Let w =the velocity of the two particles after they coalesce.

$$\text{Then } w = \sqrt{[u^2 + u_1^2 + 2uu_1 \cos(\theta + \varphi)]}.$$

\therefore Their path is $y = x \tan C - gx^2/2w^2 \cos^2 C$.

Ordinate of vertex $= w^2 \sin^2 C / 2g$.

Latus rectum $= -2w^2 \cos^2 C / g$.

$$\text{Height of latus rectum above } D = \frac{w^2}{2g} (\sin^2 C - \cos^2 C) = \frac{w^2}{2g} (1 - 2\cos^2 C) = k$$

Height of latus rectum above plane of $AB = h + k$.

131. Proposed by F. P. MATZ, Sc. D., Ph. D., Professor of Mathematics and Astronomy in Defiance College, Defiance, Ohio.

If the distributed weight on the foundations of a building is $W \text{ lb./(feet)}^2$, the foundations must be sunk $D = (W/w)\tan^4(\frac{1}{4}\pi - \frac{1}{2}\psi)$ feet deep in earth of density $w \text{ lb./(feet)}^3$ and angle of repose ψ .

No solution of this problem has been received.

132. Proposed by T. U. TAYLOR, C. E., Department of Engineering, University of Texas, Austin, Tex.

1. A parabola, whose axis is vertical, is described on the vertical face of a reservoir wall. If the vertex O of the parabola is at the bottom of the wall, and the parabola intersects the surface in the points A , B , find the depth of the center of pressure of the water on the parabolic area ABO .

2. In the same problem find the center of pressure on the area included between the horizontal line through O , a vertical through B , and the curve OB .

Solution by P. H. PHILBRICK, C. E., Lake Charles, La.

The general formula for the center of pressure, is

$$\bar{x} = \frac{\iint h x dx dy}{\iint h dx dy}$$

in which h is the depth of any point below the surface.

Let O be the origin, its depth being a , and the ordinate on the surface $= b$.